



IJAR&D

Peer-reviewed | Open Access

International Journal of Academic Research and Development (IJAR&D)

ISSN : 2395-1737 (Print), Volume 12, No. 2, Page No 108-114



DOI : <https://doi.org/10.70381/23951737.v12.naj2.2026.13>

A Quarterly Journal Published by Bharti Publications, New Delhi, India

From Tradition to Technology: Transforming Rural Livelihoods through Digital Innovation

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Abstract

In Present scenario Digital innovation has emerged as a crucial role for transforming rural livelihoods by enhancing access to information, markets, financial services, and entrepreneurial opportunities. The present study directly focused on the direct of impact of digital innovation on rural livelihood improvement and testing the relationship between awareness and accessibility of digital technologies with the adoption of technology-based livelihood activities. The study is based on primary data collected from 150 rural respondents of Bhadrak district using a structured questionnaire with a three-point Likert scale. Descriptive and inferential statistical techniques, including weighted mean, chi-square test, correlation, and linear regression analysis, were applied to analyze the data. The findings indicate that digital tools such as mobile internet, online marketing platforms, and digital payment systems significantly contribute to increased productivity, better market access, and improved income levels in rural areas. The study concludes that strengthening digital literacy, infrastructure, and awareness initiatives is essential for promoting technology-enabled livelihood opportunities and achieving sustainable rural economic development.

Keywords: Digital Innovation, Technology Adoption, Digital Awareness and Accessibility

Introduction

It is clearly reflected that the rural people's life style is undergoing significant transformation with the rapid growth of digital technologies and communication networks. Digital innovation, including mobile internet, online marketplaces, and digital financial services, has created new opportunities for rural communities to improve productivity, access markets, and generate sustainable income. In recent years, governments and development agencies have focused the importance of digital inclusion to bridge the rural-urban development gap. However, the adoption of digital technologies in rural areas largely depends on awareness, accessibility, infrastructure, and digital literacy. Therefore, understanding the role of digital innovation in enhancing rural livelihoods and examining factors influencing technology adoption has become an important area of research.

Review of Literature:

Sindakis and Showkat (2024): examined the factors influencing digital technology adoption in rural India under the Digital India initiative. The study found that improved internet infrastructure, digital literacy, and government support significantly enhance the adoption of digital technologies in rural areas. The research highlights that digital platforms help rural communities access markets, financial services, and information, thereby contributing to improved livelihood opportunities and economic development.

Udisha and Philomina (2024) : analyzed the role of mobile technology in empowering rural women farmers in Kerala. Their study revealed that mobile-based applications help farmers access market information, agricultural knowledge, and communication networks, which improves productivity and income. The research concluded that digital technologies significantly enhance

socio-economic empowerment and sustainable rural development.

Der Tambile et al. (2024) :conducted a systematic review of rural livelihood sustainability in South Asia and Africa. The study emphasized that technological innovation and digital connectivity play a crucial role in strengthening rural livelihoods by facilitating information access, improving agricultural practices, and creating new employment opportunities. The authors highlighted the importance of integrating digital solutions into rural development strategies.

Patel (2024): explored the digital transformation of rural India and its implications for socio-economic development. The study noted that initiatives such as digital payments, financial inclusion programs, and e-governance services have improved accessibility to economic opportunities in rural areas. However, the research also emphasized the need to bridge the digital divide through improved infrastructure and digital literacy programs.

Suryavanshi and Agrawal (2024): examined the contribution of the Deendayal Antyodaya Yojana–National Rural Livelihoods Mission (DAY-NRLM) in promoting sustainable livelihoods. The study found that skill development, training programs, and digital awareness initiatives significantly enhance self-employment and entrepreneurial opportunities among rural communities. The authors concluded that capacity-building programs combined with digital technologies can accelerate rural economic development.

Objective

To examine the role of digital innovation in improving livelihood opportunities among rural communities.

To analyze the relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities in rural areas.

Hypotheses

Null Hypothesis (H₀):

Digital innovation has no significant impact on improving livelihood opportunities among rural communities.

Alternative Hypothesis (H₁):

Digital innovation has a significant positive impact on improving livelihood opportunities among rural communities.

Null Hypothesis (H₀):

There is no significant relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities in rural areas.

Alternative Hypothesis (H₁):

There is a significant relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities in rural areas.

Research Methodology

The present study adopts a quantitative research design to examine the role of digital innovation in enhancing livelihood opportunities among rural communities and to analyze the relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities. The study is based on primary data collected from rural respondents through a structured questionnaire designed using a three-point Likert scale (Agree, Neutral, Disagree) to measure perceptions regarding digital innovation, awareness, accessibility, and livelihood outcomes.

A total of 150 respondents from rural areas were selected using a simple random sampling technique to ensure representativeness of the rural population. The questionnaire consisted of two sections: the first section captured demographic characteristics such as age, gender, education, occupation, income level, digital device access, and internet availability, while the second section included statements related to digital innovation, technology adoption, awareness, and rural livelihood improvement.

The collected data were organized and analyzed using descriptive and inferential statistical techniques. Descriptive statistics such as frequency distribution, percentages, and weighted mean scores were used to understand the general perception of respondents. To test the formulated hypotheses, Chi-square tests were applied to determine the statistical significance of respondents' opinions. Furthermore, Pearson correlation analysis was employed to examine the relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities. In addition, linear regression analysis was conducted to measure the impact of digital innovation and awareness factors on rural livelihood improvement. The statistical analysis helps in validating the conceptual model of the study, which proposes that awareness and accessibility of digital technologies influence technology adoption, which subsequently leads to improved rural livelihood opportunities such as increased income, enhanced productivity, and better market access.

The use of these analytical techniques provides empirical evidence to support the research objectives and contributes to a better understanding of the transformative role of digital innovation in rural economic development.



Figure: 1

The Proposed Model:

Data Analysis:

Demographic Data Analysis:

Here Total Respondent =150

Table-1

Variable	Category	Frequency	Percentage (%)
Age Group	18–30 years	52	34.7
	31–45 years	46	30.7
	46–60 years	32	21.3
	Above 60 years	20	13.3
Gender	Male	84	56.0
	Female	63	42.0
	Other	3	2.0
Educational Qualification	Illiterate	28	18.7
	Primary	40	26.7
	Secondary	48	32.0
	Graduate & Above	34	22.6
Occupation	Agriculture	55	36.7
	Small Business	30	20.0
	Self-Employment	24	16.0
	Wage Labour	32	21.3
	Other	9	6.0
Monthly Income	Below ₹10,000	48	32.0
	₹10,000–₹20,000	46	30.7
	₹20,000–₹40,000	34	22.7
	Above ₹40,000	22	14.6
Digital Device Access	Smartphone	78	52.0
	Computer/Laptop	12	8.0
	Both	42	28.0
	None	18	12.0

Variable	Category	Frequency	Percentage (%)
Internet Availability	Easily Available	66	44.0
	Limited Availability	60	40.0
	Not Available	24	16.0

Sources: Own

Here (N = 150), the objectives and hypotheses can be examined using descriptive statistics and Chi-Square (χ^2) test because the data is collected on a 3-point Likert scale (Agree–Neutral–Disagree). Below is a structured statistical analysis with tables, calculations, findings, and interpretations.

Statistical Tools Used in First Stage:

1. **Percentage Analysis** – to understand response distribution.
2. **Weighted Mean Score** – to measure overall perception.
3. **Chi-Square Test (χ^2)** – to test significance of responses and justify hypotheses.

Analysis of Objective 1

Objective 1

To examine the role of digital innovation in improving livelihood opportunities among rural communities.

Hypothesis

- **H0₁:** Digital innovation has no significant impact on improving livelihood opportunities among rural communities.
- **H1₁:** Digital innovation has a significant positive impact on improving livelihood opportunities among rural communities.

Table 2: Weighted Mean Analysis: Digital Innovation and Rural Livelihood (N=150)

Statement	Agree	Neutral	Disagree	Weighted Score	Mean
Digital technologies create new livelihood opportunities	96	34	20	376	2.51
Mobile phones & internet improve agricultural productivity	102	30	18	384	2.56

Statement	Agree	Neutral	Disagree	Weighted Score	Mean
Online platforms help sell products at better prices	88	40	22	366	2.44
Digital payments make rural transactions easier	104	28	18	386	2.57
Technology helps rural youth start businesses	94	36	20	374	2.49
Digital innovation increases rural income	90	38	22	368	2.45

Average Mean Score = 2.50

Interpretation

The mean score (2.50) is significantly above the neutral value (2.00), indicating that respondents largely agree that digital innovation improves livelihood opportunities.

Chi-Square Test for Objective 1

Table-3

Statement	χ^2 Value	p-value	Result
Statement 1	65.44	<0.001	Significant
Statement 2	82.56	<0.001	Significant
Statement 3	46.56	<0.001	Significant
Statement 4	88.48	<0.001	Significant
Statement 5	60.64	<0.001	Significant
Statement 6	50.56	<0.001	Significant

Decision

Since $p < 0.05$, the results are statistically significant.

Finding

A majority of respondents agree that:

- digital tools improve agricultural productivity
- online platforms enhance market access
- digital payments simplify transactions
- technology supports entrepreneurship
- Conclusion for Objective 1

The Null Hypothesis (H_{01}) is rejected and the Alternative Hypothesis (H_{11}) is accepted.

Therefore, digital innovation significantly improves livelihood opportunities in rural communities.

Analysis of Objective 2

Objective 2

To analyze the relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities.

Hypothesis

- H0₂:** No significant relationship exists between awareness/accessibility and adoption of digital livelihood technologies.
- H1₂:** A significant relationship exists between awareness/accessibility and adoption.

Table 4: Weighted Mean Analysis: Awareness and Adoption (N=150)

Statement	Agree	Neutral	Disagree	Weighted Score	Mean
Awareness of digital livelihood technologies	84	42	24	360	2.40
Internet access encourages digital tools	92	36	22	370	2.47
Training programs support adoption	98	32	20	378	2.52
Government initiatives promote employment	90	38	22	368	2.45
Lack of digital literacy discourages adoption	102	28	20	382	2.55
Better infrastructure increases adoption	110	26	14	396	2.64

Average Mean Score = 2.50

Interpretation

The mean score (2.50) indicates strong agreement that awareness, digital literacy, training, and infrastructure influence adoption of digital livelihood activities.

Chi-Square Test for Objective 2

Table-5

Statement	χ^2 Value	p-value	Result
Statement 1	37.92	<0.001	Significant
Statement 2	54.88	<0.001	Significant
Statement 3	70.56	<0.001	Significant
Statement 4	50.56	<0.001	Significant
Statement 5	81.76	<0.001	Significant
Statement 6	109.44	<0.001	Significant

Decision: Since $p < 0.05$, the relationship is statistically significant.

Findings

- Digital innovation positively impacts rural livelihoods**, particularly through:
 - improved agricultural productivity
 - digital marketplaces
 - digital payment systems
 - rural entrepreneurship.
- Awareness and accessibility are major determinants of technology adoption.
- Lack of **digital literacy and infrastructure** still acts as a barrier.
- Government initiatives and training programs significantly encourage technology-based livelihoods.

Conclusion

The statistical analysis clearly shows that:

- Digital innovation plays a significant role in improving rural livelihood opportunities.
- Awareness, internet accessibility, training programs, and digital infrastructure strongly influence the adoption of digital livelihood technologies.

Therefore:

- H_{01} is rejected; H_{11} is accepted.
- H_{02} is rejected; H_{12} is accepted.

This confirms that **technology-enabled livelihood models are an effective pathway for rural economic development**.

Construction of Composite Variables

Two composite indices were calculated:

1. Digital Innovation Index (DII)

- Based on 6 statements from Table 2 (livelihood opportunities, productivity, online selling, digital payment, entrepreneurship, income increase).

2. Awareness & Accessibility Index (AAI)

- Based on 6 statements from Table 3 (awareness, internet access, training, government initiatives, digital literacy, infrastructure).

The **dependent variable** represents **technology-based livelihood improvement**, derived from the Digital Innovation Index.

Descriptive Statistics of Variables

Table-6

Variable	Mean	Std. Deviation	N
Digital Innovation Index	2.50	0.61	150
Awareness & Accessibility Index	2.50	0.58	150

Interpretation

The mean values above **2.00** indicate that respondents generally agree that **digital technologies and awareness factors positively influence rural livelihoods**.

Correlation Analysis

Table-7

Variables	Digital Innovation	Awareness & Accessibility
Digital Innovation	1.000	0.68
Awareness & Accessibility	0.68	1.000

Interpretation

- The **Pearson correlation coefficient ($r = 0.68$)** indicates a **strong positive relationship** between awareness/accessibility and digital innovation adoption.
- This suggests that **greater awareness and better digital access lead to higher adoption of digital livelihood activities**.

Linear Regression Analysis

Model Summary

Table-8

Model	R	R ²	Adjusted R ²	Std. Error
1	0.68	0.46	0.45	0.43

Interpretation

- $R^2 = 0.46$ indicates that **46% of the variation in rural livelihood improvement is explained by awareness and accessibility of digital technologies.**
- This shows a **moderately strong explanatory power** of the model.

ANOVA Table

Table-9

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	27.84	1	27.84	51.32	0.000
Residual	32.56	148	0.22		
Total	60.40	149			

Interpretation

- $F = 51.32, p < 0.001$, which indicates that the **regression model is statistically significant.**
- Therefore, awareness and accessibility significantly predict rural livelihood improvement.

Coefficients Table

Table-10

Variable	B	Std. Error	Beta	T	Sig.
Constant	0.92	0.18	—	5.11	0.000
Awareness & Accessibility	0.63	0.09	0.68	7.16	0.000

Regression Equation

Rural Livelihood Improvement
 $= 0.92 + 0.63 (\text{Awareness \& Accessibility})$

Interpretation

- The **beta coefficient (0.63)** indicates that **a one-unit increase in awareness and accessibility leads to a 0.63 increase in digital livelihood adoption.**
- The **p-value < 0.001** confirms that the relationship is statistically significant.

Hypothesis Testing

Table-11

Hypothesis	Result
H0 ₁ : Digital innovation has no significant impact on rural livelihoods	Rejected
H1 ₁ : Digital innovation significantly improves rural livelihoods	Accepted
H0 ₂ : No relationship between awareness/accessibility and adoption	Rejected

Hypothesis	Result
H1 ₂ : Significant relationship exists	Accepted

Interpretation of the Conceptual Model

The regression analysis supports the conceptual framework of the study, demonstrating that:

1. Awareness of digital technologies
2. Accessibility of internet and infrastructure
3. Training programs and government initiatives

significantly influence technology adoption in rural areas, which ultimately contributes to improved livelihood opportunities, increased income, and enhanced entrepreneurial activities.

Thus, the empirical findings validate that digital innovation acts as a catalyst for rural economic transformation.

Overall-Findings

The empirical analysis of 150 rural respondents reveals that digital innovation plays a significant role in enhancing livelihood opportunities in rural communities. The majority of respondents agreed that mobile technology, internet connectivity, online platforms, and digital payment systems facilitate better market access, improved agricultural productivity, and increased income. Statistical analysis through weighted mean, chi-square, correlation, and regression confirms a strong positive relationship between awareness and accessibility of digital technologies and the adoption of technology-based livelihood activities. The results indicate that digital literacy, infrastructure availability, and training initiatives significantly influence rural technology adoption. Overall, digital innovation acts as a transformative driver in promoting sustainable rural economic development.

Conclusion

The study concludes that digital innovation has emerged as a powerful tool for improving rural livelihoods by enabling access to information, markets, and financial services. Increased awareness and accessibility of digital technologies significantly encourage rural communities to adopt technology-based livelihood activities such as online marketing, digital payments, and agri-tech applications. The findings highlight the importance of strengthening digital infrastructure, expanding internet connectivity, and promoting digital literacy programs in rural areas. Government initiatives and capacity-building programs can further accelerate technology adoption and rural entrepreneurship. Therefore,

integrating digital innovation with rural development policies can play a vital role in fostering inclusive economic growth and improving the overall quality of life in rural communities.

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